

### REMARKS

Claims 17-57 are pending in the present application. Claims 17-57 were rejected under 35 U.S.C. 132 as introducing new matter into the disclosure of the invention. The Examiner states that the added material not supported by the original disclosure is as follows:  $\delta_s$  and  $\delta_p$ , nor their relationship to one another, nor a local surface mobility requirement, nor plastic-dye solution contact times.

Applicants have carefully considered the issues presented by the Examiner in reference to the subscripts "p" and "s" used with the  $\delta$  symbol, and their relationship to one another. In light of this consideration, Applicants have amended claims 17, 19, 39 and 41 to delete the subscripts "p" and "s" from the delta ( $\delta$ ) symbols and provide alternative language for distinguishing between the solubility parameters of the solvent and the plastic material in the claims. Moreover, Applicants have also deleted the word "near" in Claims 17 and 39. These amendments were made to correct typographical errors and eliminate certain objectionable terminology, and such amendments are not material to patentability. Complete support for the Amended claims is provided in the underlined portions of the attached pages 3 and 4 of the specification.

Next, Applicants have amended claims 18 and 40 to recite, *inter alia*, wherein the plasticizer provides local surface mobility to the plastic matrix. It is well known in the art that plasticizers can be incorporated into various materials (e.g., adhesives, plastic, etc.) during manufacture to increase, e.g., the material's flexibility, workability, or distensibility. Indeed, the present disclosure describes, e.g., on page 3, paragraph 2, that plasticizers are sometimes used during manufacturing to give an otherwise rigid plastic flexibility (though it is preferred that the plastic material used in the present invention

have no plasticizer prior to its formation). The specification further discloses wherein the **plasticizer provides local surface mobility** to the plastic matrix, essentially as claimed in amended claims 18 and 40.

Finally, Applicants have amended claim 20 to recite, *inter alia*, wherein the surface is contacted with the solution for less than about **one minute**. The specification, e.g., page 4, lines 8-9, discloses wherein the polycarbonate article is contacted with the solution (the solution comprising the aggressive solvent(s), plasticizer and dye) for at least ten (10) seconds, but **generally not more than one minute**, essentially as claimed in amended claim 20.

For the Examiner's convenience, Applicants have enclosed herewith pages 3 and 4 of the certified copy of the specification as filed on April 11, 2000.

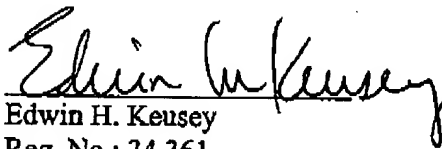
This set of Amendments brings the claims into closer conformity with the claims originally filed and searched, but in a more straight-forward and improved format.

Thus, Applicants respectfully submit that the disclosure of the present invention as filed adequately supports the claims as filed in the amendment of December 21, 2001. Accordingly, the withdrawal of the rejections under 35 U.S.C. 132 is respectfully requested.

**CONCLUSION**

In view of the foregoing remarks, it is respectfully asserted that the case is in condition for allowance. Consequently, Applicants request reconsideration of the rejection and allowance of the application. Such early and favorable consideration by the Examiner is earnestly solicited. Should the Examiner believe that a telephone or personal interview may facilitate resolution of any remaining matters, it is urged that the Examiner please contact the Applicants' undersigned attorney. It is respectfully requested that such contact be made prior to the 3 month deadline of June 14, 2002, if possible.

Respectfully submitted,

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Attachments: Marked Up Claims (2 Pages)  
Underlined portions of specification (2 pages)

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**MARKED UP VERSION OF AMENDED CLAIMS**

17. (Amended) A method of infusing a dye into a surface of a plastic material having a solubility parameter [ $\delta_p$ ]  $\delta$ , comprising the steps of:

dissolving a dye and a plasticizer into an aggressive solvent having a solubility parameter [ $\delta_s$  near  $\delta_p$ ]  $\delta$  to form a solution; and

contacting the surface of the plastic with the solution.

18. (Amended) The method of claim 17, wherein the plastic material comprises a plastic matrix and the dissolved plasticizer in the solution [induces] provides local surface mobility [within] to the plastic matrix.

19. (Amended) The method of claim 17, wherein [ $\delta_s$  and  $\delta_p$  are] each solubility parameter  $\delta$  is measured in  $(\text{cal}/\text{cm}^3)^{0.5}$  and wherein [ $\delta_s$ ] the solubility parameter of the aggressive solvent is within 1  $(\text{cal}/\text{cm}^3)^{0.5}$  of [ $\delta_p$ ] the solubility parameter of the plastic material.

20. (Amended) The method of claim 17, wherein the surface is contacted with the solution for less than about [60 seconds] one minute.

39. (Amended) An article having a mixture infused therein by a solvent comprising:

a plastic material having a surface and a solubility parameter [ $\delta_p$ ]  $\delta$ ; and

a mixture of dye and a plasticizer infused into the surface, with said mixture having been infused while being dissolved in an aggressive solvent having a solubility parameter [ $\delta_s$  near  $\delta_p$ ]  $\delta$ .

40. (Amended) The article of claim 39, wherein the plastic material comprises a plastic matrix and the plasticizer [induces] provides local surface mobility [within] to the plastic matrix.

41. (Amended) The article of claim 39, wherein [ $\delta_s$  and  $\delta_p$  are] the solubility parameter  $\delta$  of the plastic material and the solubility parameter  $\delta$  of the aggressive solvent are each measured in  $(\text{cal}/\text{cm}^3)^{0.5}$ , and wherein [ $\delta_s$ ] the solubility parameter of the aggressive solvent is within 1  $(\text{cal}/\text{cm}^3)^{0.5}$  of [ $\delta_p$ ] the solubility parameter of the plastic material.

premature deterioration of a photochromic dye. Suitable photochromic dyes include palatinate purple, sea green, corn yellow and berry red which may be obtained from James Robinson, Ltd. of Huddersfield, United Kingdom.

A solvent aggressive to the plastic and also capable of dissolving the dye and a plasticizer is selected. An aggressive solvent is one which has a solubility parameter  $\delta$  which, according to the theorem of Hildebrand, is within plus or minus 1 of the solubility parameter of the plastic when measured in  $(\text{cal}/\text{cm}^3)^{0.5}$ .

Polycarbonate for example has a solubility parameter  $\delta$  of 9.8  $(\text{cal}/\text{cm}^3)^{0.5}$ .

Suitable aggressive solvents for polycarbonate are tetrahydrofuran ( $\text{C}_4\text{H}_8\text{O}$ ,  $\delta = 9.1$ ) and chlorinated hydrocarbons, for example, chloroform ( $\text{CHCl}_3$ ,  $\delta = 9.3$ ), methylene chloride ( $\text{CH}_2\text{Cl}_2$ ,  $\delta = 9.7$ ) and dichlorobenzene ( $\text{C}_6\text{H}_4\text{Cl}_2$ ,  $\delta = 10.0$ ).

The aggressive nature of the solvent allows the dye to penetrate to a sufficient depth of 75 to 150 microns below the surface of the article, enabling good dye density. A combination of aggressive solvents may be used. The use of non-aggressive solvents is disadvantageous because they do not provide sufficient dye penetration and further may be difficult to drive off. Although acetone has a solubility parameter of 9.9, its use should be avoided, since it is too volatile and causes crystallization of polycarbonate. Further, dodecanol-1, having a solubility parameter of 9.8, is not recommended because even higher alcohols are somewhat hydrophilic and tend to absorb water vapor.

Plasticizers are sometimes used during manufacturing to give an otherwise rigid plastic flexibility; but as previously indicated we prefer that the plastic have no plasticizer prior to formation of the article. In the present application, the infused plasticizer provides local surface mobility to the plastic matrix, allowing the deeply penetrating solvent to almost completely evaporate during subsequent heating. Where the plastic is polycarbonate, the plasticizer may be selected from the following table which includes both acid and alcohol moieties.

Table 1 - Listing of Acceptable Plasticizers

Trade Name	Chemical Name	Chemical Formula
Benzoflex <sup>®</sup> P-200	Polyethyleneglycol dibenzoate	$(C_7H_5O)_2C_{12}H_{20}O_3$
Benzoflex <sup>®</sup> S-552	Pentacrythritol tetrabenzoate	$C_{13}H_{18}O_4$
DOP	Diethyl phthalate 98%	$C_6H_4-1,2-(CO_2CH_2)_2$
DPP	Dipropyl phthalate 99%	$C_6H_4-1,2-(CO_2CH_2CH_2CH_3)_2$
DMP	Dimethyl phthalate 99%	$C_6H_4-1,2-[CO_2CH_2CH(C_2H_5)(CH_3)]_2$
DOA	Diethyl Adipate 99%	$C_{22}H_{40}O_4$
DOS	Diethyl Sebacate 99%	$[-CH_2CH_2CO_2CH_2CH(C_2H_5)(CH_3)]_2$

One or more of these plasticizers may be used in combination. The plasticizers sold under the trademark BENZOFLEX<sup>®</sup> may be obtained from Velsicol Chemical Corporation of Rosemont, Illinois.

The treating solution comprises the aggressive solvent or solvents, typically 1% to 4%, or more, by weight of plasticizer dissolved in the solvent and a conventional quantity of dye dissolved in the solvent. As a general rule, it is preferable to use the minimum concentration of plasticizer necessary to achieve the desired result. The polycarbonate article is contacted with the solution for at least ten seconds, but generally not more than one minute. In the case of a lens, one or both surfaces of the lens may be coated with the solution or the lens may be completely immersed in the solution. In the case of immersion, the article is removed from the solution at a uniform withdrawal rate. The solvent is then evaporated from the surface layer of the article by annealing. In practice, annealing consisted of heating the article from 85°F to 265°F in four hours and then cooling the article from 265°F to 85°F in one hour. It will be appreciated that the maximum temperature is appreciably less than the glass transition temperature of polycarbonate of 305°F. = 152°C.

The resulting dyed article is transparent, having a surface layer with a depth of the order of 75 to 150 microns, which contains the infused dye and